receptacle vessel 162 of the MTU 160 at a laterally off-center position with respect to the receptacle vessel 162. Each nozzle includes a laterally-directed lower portion 859 for directing the wash buffer into the respective receptacle vessel from the off-center position. Dispensing fluids into the receptacle vessels 162 in a direction having a lateral component can limit splashing as the fluid runs down the sides of the respective receptacle vessels 162. In addition, the laterally directed fluid can rinse away materials clinging to the sides of the respective receptacle vessels 162.

As shown in FIGURES 24 and 25, aspirator tubes 860 extend through a tube holder 862, to which the tubes 860 are fixedly secured, and extend through openings 861 in the divider 808. A tube guide yoke 809 (see FIGURE 26) is attached by mechanical fasteners to the side of divider 808, below openings 861. Aspirator hoses 864 connected to the aspirator tubes 860 extend to the vacuum pump 1162 (see FIGURE 52) within the analyzer 50, with aspirated fluid drawn off into a fluid waste container carried in the lower chassis 1100. Each of the aspirator tubes 860 has a preferred length of 12 inches with an inside diameter of 0.041 inches.

The tube holder 862 is attached to a drive screw 866 actuated by a lift motor 868. Lift motor 868 is preferably a VEXTA, model number PK245-02A, available from Oriental Motors Ltd. of Tokyo, Japan, and the drive screw 866 is preferably a ZBX series threaded anti-backlash lead screw, available from Kerk Motion Products, Inc. of Hollis, New Hampshire. The tube holder 862 is attached to a threaded sleeve 863 of the drive screw 866. Rod 865 and slide rail 867 function as a guide for the tube holder 862. Z-axis sensors 829, 827 (slotted optical sensors) cooperate with a tab extending from threaded sleeve 863 to indicate top and bottom of stroke positions of the aspirator tubes 860. The Z-axis sensors are preferably Optek Technology, Inc., model number OPB980T11, sensors, available from Optek Technology, Inc. of Carrollton, Texas.

Cables bring power and control signals to the magnetic separation wash station 800, via a connector 870.

The magnet moving structure 810 is initially in a down position (shown in phantom in FIGURE 25), as verified by the sensor 818, when the MTU 160 is inserted into the magnetic separation wash station 800 through the insert opening 804 and into the MTU carrier unit 820. When the magnet moving structure 810 is in the down position, the magnetic fields of the magnets 814 will have no substantial effect on the magnetically responsive particles contained in the MTU 160. In the present context, "no substantial effect" means that the magnetically

responsive particles are not drawn out of suspension by the attraction of the magnetic fields of the magnets 814. The orbital mixer assembly 828 moves the MTU carrier unit 820 a portion of a complete orbit so as to move the carrier unit 820 and MTU 160 laterally, so that each of the tiplets 170 carried by the tiplet holding structures 176 of the MTU 160 is aligned with each of the aspiration tubes 860, as shown in FIGURE 28. The position of the MTU carrier unit 820 can be verified by the locator plate 846 and one of the sensors 847, 848. Alternatively, the stepper motor 830 can be moved a known number of steps to place the MTU carrier unit 820 in the desired position, and one of the sensors 847, 848 can be omitted.

The tube holder 862 and aspirator tubes 860 are lowered by the lift motor 868 and drive screw 866 until each of the aspirator tubes 860 frictionally engages a tiplet 170 held in an associated carrying structure 176 on the MTU 160.

As shown in FIGURE 25A, the lower end of each aspirator tube 860 is characterized by a tapering, step construction, whereby the tube 860 has a first portion 851 along most of the extent of the tube, a second portion 853 having a diameter smaller than that of the first portion 851, and a third portion 855 having a diameter smaller than that of the second portion 853. The diameter of the third portion 855 is such as to permit the end of the tube 860 to be inserted into the flared portion 181 of the through hole 180 of the tiplet 170 and to create an interference friction fit between the outer surface of third portion 855 and the two annular ridges 183 (see FIGURE 59) that line the inner wall of hole 180 of tiplet 170. An annular shoulder 857 is defined at the transition between second portion 853 and third portion 855. The shoulder 857 limits the extent to which the tube 860 can be inserted into the tiplet 170, so that the tiplet can be stripped off after use, as will be described below.

The tiplets 170 are at least partially electrically conductive, so that the presence of a tiplet 170 on an aspirator tube 860 can be verified by the capacitance of a capacitor comprising the aspirator tubes 860 as one half of the capacitor and the surrounding hardware of the magnetic separation wash station 800 as the other half of the capacitor. The capacitance will change when the tiplets 170 are engaged with the ends of the aspirator tubes 860.

In addition, five optical slotted sensors (not shown) can be strategically positioned above the divider 808 to verify the presence of a tiplet 170 on the end of each aspirator tube 860. Preferred "tiplet-present" sensors are Optek Technology, Inc., model number OPB930W51, sensors, available from Optek Technology, Inc. of Carrollton, Texas. A tiplet 170 on the end of an aspirator tube 860 will break the beam of an associated sensor to verify presence of the tiplet

170. If, following a tiplet pick-up move, tiplet engagement is not verified by the tiplet present sensors for all five aspirator tubes 860, the MTU 160 must be aborted. The aborted MTU is retrieved from the magnetic separation wash station 800 and sent to the deactivation queue 750 and ultimately discarded.

After successful tiplet engagement, the orbital mixer assembly 828 moves the MTU carrier unit 820 back to a fluid transfer position shown in FIGURE 27 as verified by the locator plate 846 and one or both of the sensors 847, 848.

The magnet moving structure 810 is then raised to the up position shown in FIGURE 24 so that the magnets 814 are disposed adjacent opposite sides of the MTU 160. With the contents of the MTU subjected to the magnetic fields of the magnets 814, the magnetically responsive particles bound indirectly to the target nucleic acids will be drawn to the sides of the individual receptacle vessels 162 adjacent the magnets 814. The remaining material within the receptacle vessels 162 should be substantially unaffected, thereby isolating the target nucleic acids. The magnet moving structure 810 will remain in the raised position for an appropriate dwell time, as defined by the assay protocol and controlled by the assay manager program, to cause the magnetic particles to adhere to the sides of the respective receptacle vessels 162.

The aspirator tubes are then lowered into the receptacle vessels 162 of the MTU 160 to aspirate the fluid contents of the individual receptacle vessels 162, while the magnetic particles remain in the receptacle vessels 162, adhering to the sides thereof, adjacent the magnets 814. The tiplets 170 at the ends of the aspirator tubes 860 ensure that the contents of each receptacle vessel 162 do not come into contact with the sides of the aspirator tubes 860 during the aspirating procedure. Because the tiplets 170 will be discarded before a subsequent MTU is processed in the magnetic separation wash station 800, the chance of cross-contamination by the aspirator tubes 860 is minimized.

The electrically conductive tiplets 170 can be used in a known manner for capacitive fluid level sensing within the receptacle vessels 162 of the MTUs. The aspirator tubes 860 and the conductive tiplets 170 comprise one half of a capacitor, the surrounding conductive structure within the magnetic separation wash station comprises the second half of the capacitor, and the fluid medium between the two halves of the capacitor constitutes the dielectric. Capacitance changes due to a change in the nature of the dielectric can be detected.

The capacitive circuitry of the aspirator tubes 860 can be arranged so that all five aspirator tubes 860 operate as a single gang level-sensing mechanism. As a gang level-sensing